



Product Specification

M240HTN01.2

AU OPTRONICS CORPORATION

() Preliminary Specification

(v) Final Specification

Module	24.0" Color TFT-LCD
Model Name	M240HTN01.2

Customer	Date
<hr/>	<hr/>
Approved by	
<hr/>	<hr/>
Note: This Specification is subject to change without notice.	

Approved by	Date
Howard Lee	<hr/>
Prepared by	
Phoebe chen	2012/10/07
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1 Handling Precautions

- 1) Since front polarizer is easily damaged, pay attention not to scratch it.
- 2) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 3) When the cell surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 4) Since the cell is made of glass, it may break or crack if dropped or bumped on hard surface.
- 5) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 6) Do not press or pat the panel surface by fingers, hand or tooling.
- 7) Please handle TFT cell with care. The FPCs can only sustain for quite limited stress.
- 8) The cell package tray is packed in clean room. Please do pack & unpack it in clean room.
- 9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT cell.
- 10) Pls avoid touching COF position while you are doing mechanical design.
- 11) When storing modules as spares for a long time, the following precaution is necessary:
Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.



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2 General Description

This specification applies to the 24 inch-FHD color a-Si TFT-LCD Module M240HTN01.2. The display supports the FHD - 1920(H) x 1080(V) screen format and 16.7M colors (RGB 6-bit + Hi-FRC data). All input signals are 2-channel LVDS interface and this module doesn't contain a driver for backlight.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25°C condition:

Items	Unit	Specification	
Screen Diagonal	[mm]	609.7 (24.0")	
Active Area	[mm]	531.36 (H) x 298.89 (V)	
Pixels H x V		1920(x3) x 1080	
Pixel Pitch	[um]	276.75 (per one triad) ×276.75	
Pixel Arrangement		R.G.B. Vertical Stripe	
Display Mode		TN Mode, Normally White	
Optical Response Time	[msec]	5ms (Typ., on/off)	
Nominal Input Voltage VDD	[Volt]	+ 5.0 V	
Power Consumption (VDD line+LED line)	[Watt]	3.25watt Without LED BL, All black pattern at 60Hz	
Weight	[g]	514g	
Electrical Interface		Dual channel LVDS	
Support Color		16.7M colors (RGB 6-bit + Hi_FRC)	
Surface Treatment		Anti-Glare, 3H	
Cell transmittance		5.4% (Typ.)	(base on AUO LED Backlight)
		4.59%(min)	
Cell thickness	[mm]	1.5 (the thickness of polarizer film is 0.25 mm each side)	



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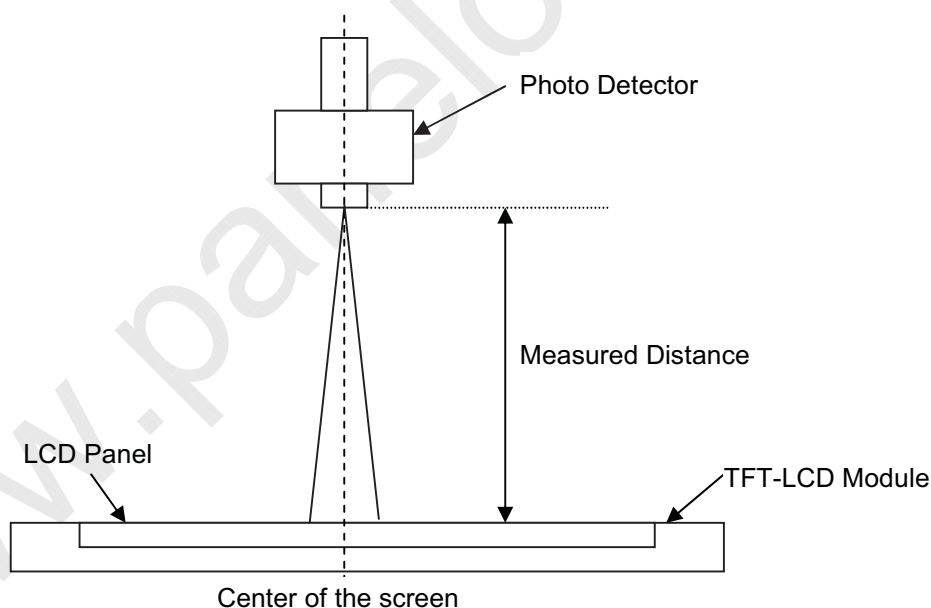
2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25°C:

Item	Unit	Conditions	Min.	Typ.	Max.	Note
Response Time	[msec]	Rising Time (TrR)	-	3.5	7.4	4
		Falling Time (TrF)	-	1.5	2.6	
		Rising + Falling	-	5	10	
Crosstalk (in 60Hz)	[%]				1.5	8
Flicker	dB				-20	9

Note 1: Measurement Method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring (at surface 35°C). In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.





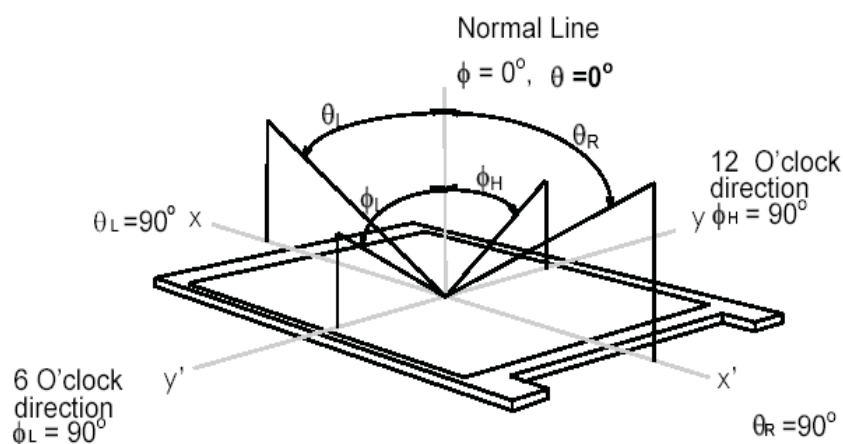
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Note 2: Definition of Viewing Angle measured by ELDIM (EZContrast 88)

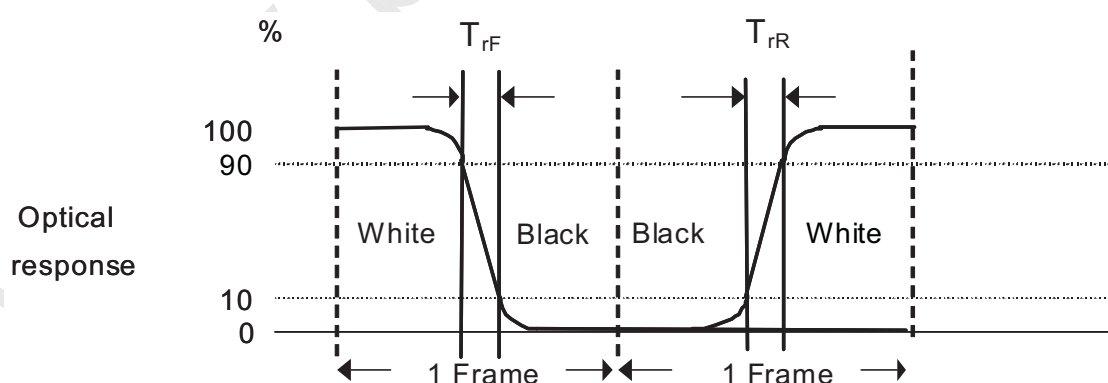
Viewing angle is the measurement of contrast ratio ≥ 10 , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



Note 3: Contrast Ratio measured by TOPCON SR-3

Note 4: Definition of Response time measured by Westar TRD-100A

The output signals of photo detector are measured when the input signals are changed from "Full Black" to "Full White" (rising time, T_{rR}), and from "Full White" to "Full Black" (falling time, T_{rF}), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.



$$T_{rR} + T_{rF} = 5 \text{ msec (typ.)}$$

Note 5: Color Chromaticity and Coordinates (CIE) measured by TOPCON SR-3

Note 6: Central Luminance measured by TOPCON SR-3

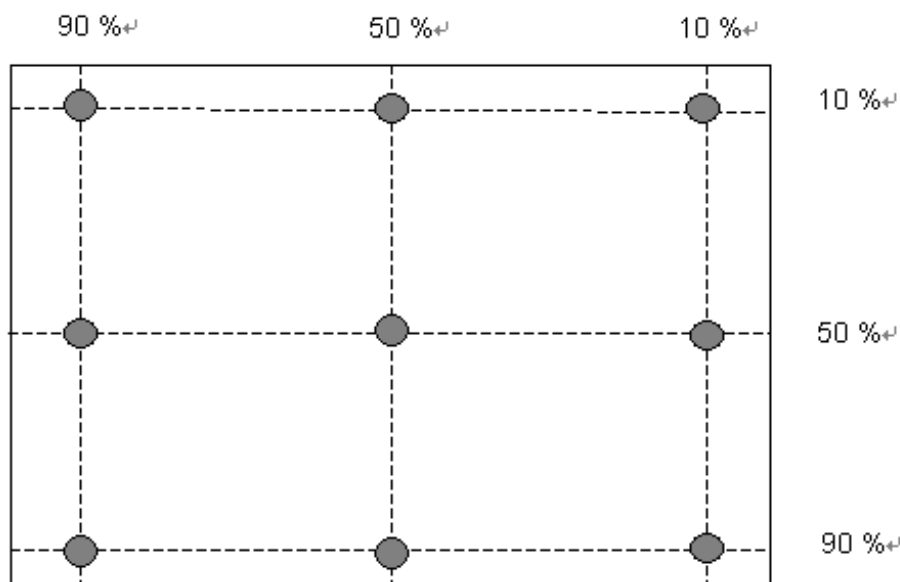


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Note 7: Luminance Uniformity of these 9 points defined as below and measured by TOPCON SR-3



$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1 - 9)}}{\text{Maximum Luminance in 9 Points (1 - 9)}}$$

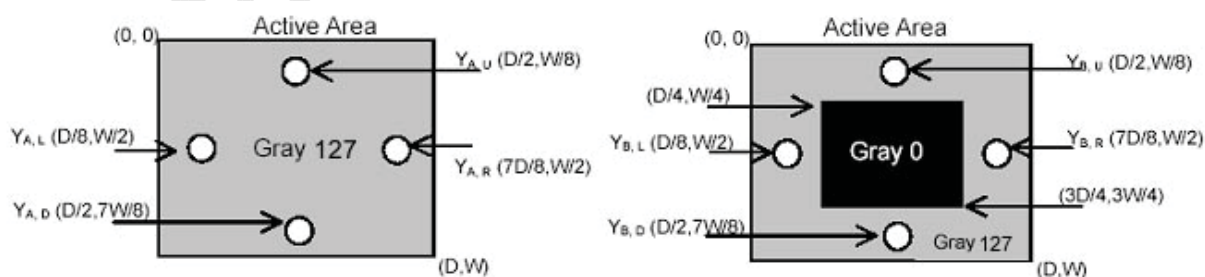
Note 8: Crosstalk defined as below and measured by TOPCON SR-3

$$\text{CT} = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where

Y_A = Luminance of measured location without gray level 0 pattern (cd/m²)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m²)



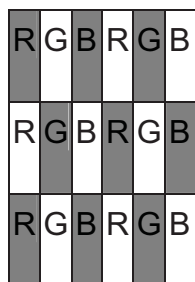


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Note 9: Test Pattern Sub-checker Pattern measured by TOPCON SR-3

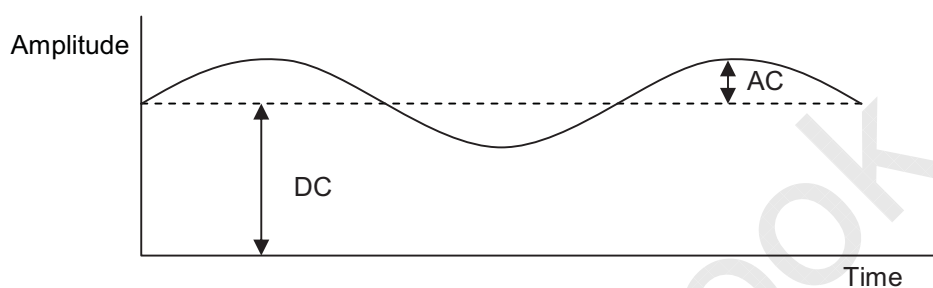


Gray Level = L127



Gray Level = L0

Method: Record dBV & DC value with TRD-100



$$\text{Flicker (dB)} = 20 \log \frac{\text{AC Level (at 30 Hz)}}{\text{DC Level}}$$



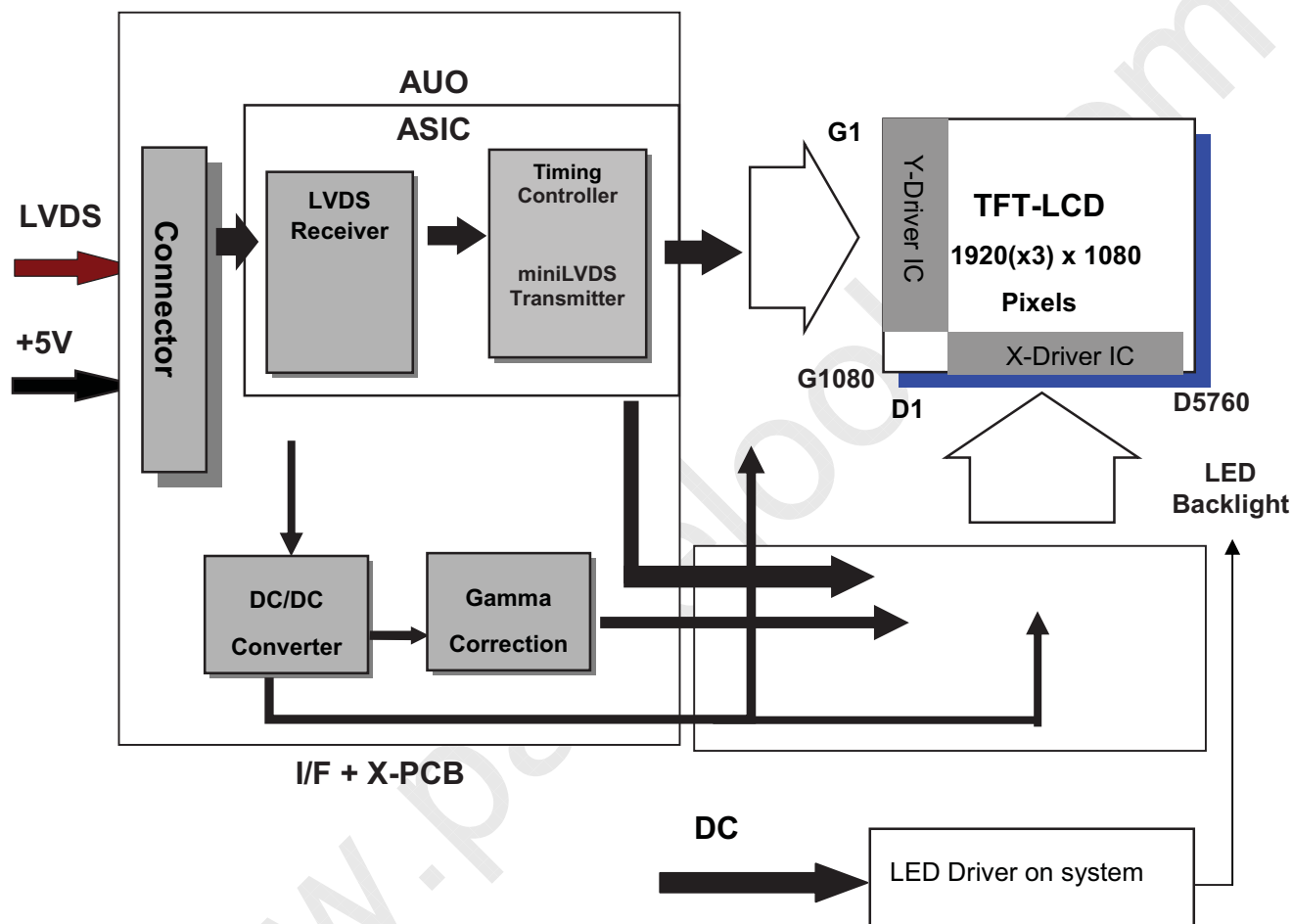
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3 Functional Block Diagram

The following diagram shows the functional block of the 24.0 inch Color TFT-LCD Module:



I/F PCB Interface:

MSCKT2407P30HB (STM)

AL230F-A0G1D-P (P-TWO)

Mating Type:

FI-X30HL(Locked Type)



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4 Absolute Maximum Ratings

Absolute maximum ratings of the module are listed as follows:

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive	VDD	-0.3	6.0	[Volt]	Note 1, 2

4.2 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 3
Glass Surface Temperature (Operation)	TGS	0	+65	[°C]	Note3 Note4
Operation Humidity	HOP	5	90	[%RH]	Note 3
Storage Temperature	TST	-20	+60	[°C]	
Storage Humidity	HST	5	90	[%RH]	

Note 1: With in Ta (25 °C)

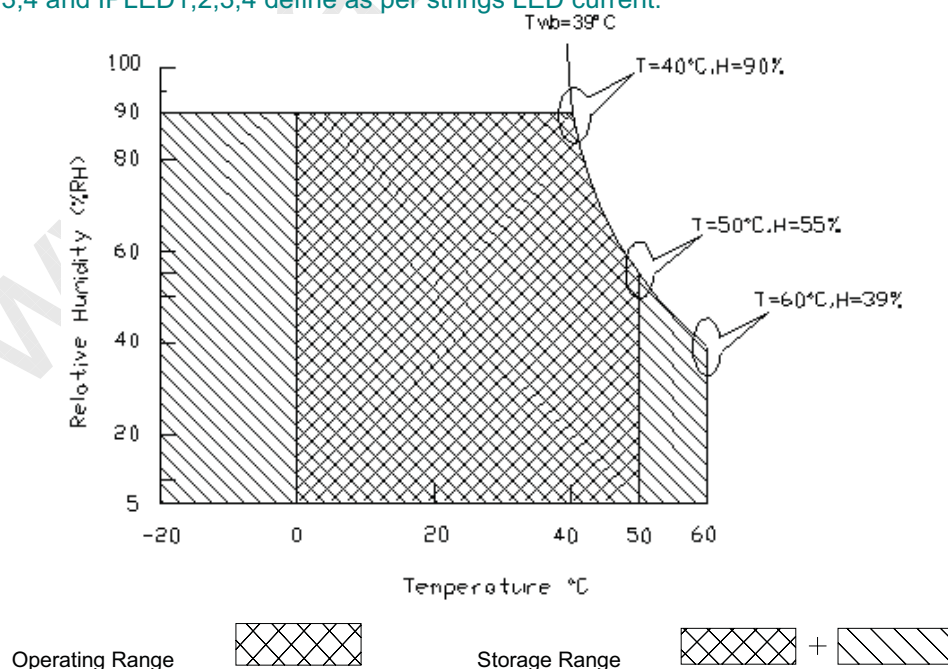
Note 2: Permanent damage to the device may occur if exceeding maximum values

Note 3: Temperature and relative humidity range are shown as the below figure.

1. 90% RH Max (Ta ≤39°C)
2. Max wet-bulb temperature at 39°C or less. (Ta ≤39°C)
3. No condensation

Note 4: Function Judged only

Note 5: IRLED1,2,3,4 and IPLED1,2,3,4 define as per strings LED current.





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5 Electrical Characteristics

5.1 TFT LCD Module

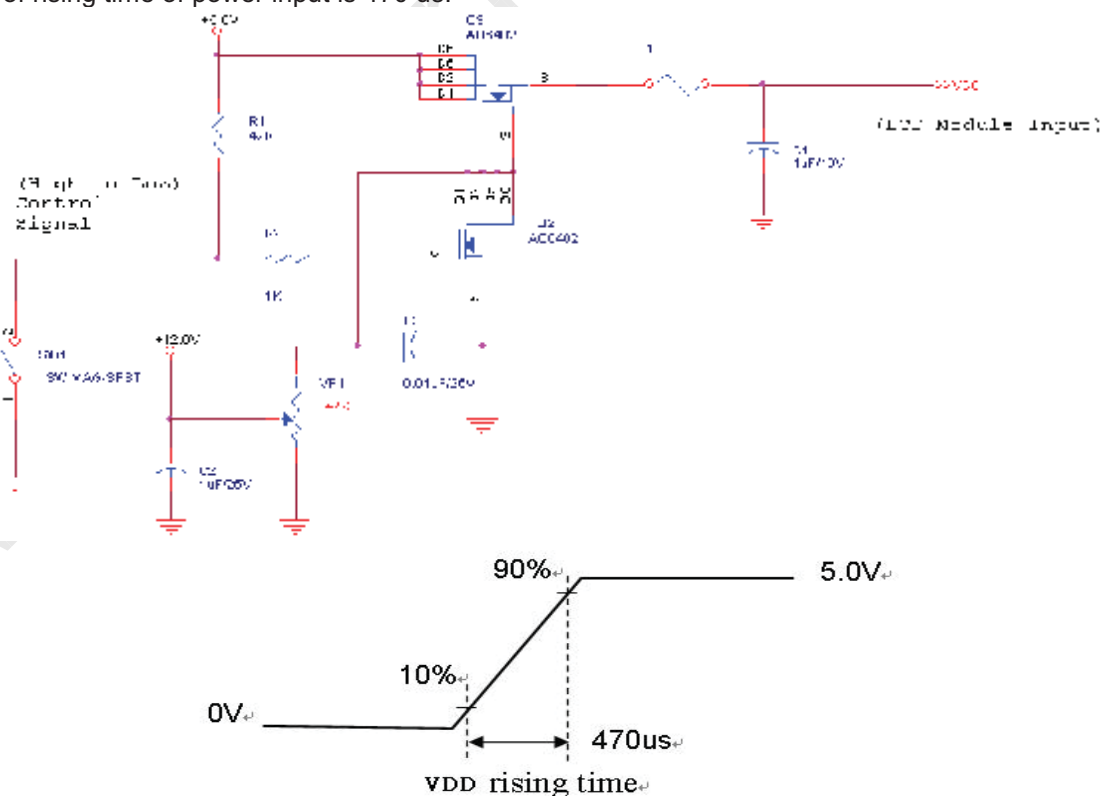
5.1.1 Power Specification

Input power specifications are listed as follows:

Symbol	Description	Min	Typ.	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD1	Input Current	-	0.65	0.78	[A]	VDD= 5.0V, All Black Pattern at 60 Hz
		-	0.8	0.96	[A]	VDD= 5.0V, All Black Pattern at 75 Hz
PDD1	VDD Power	-	3.25	3.9	[Watt]	VDD= 5.0V, All Black Pattern at 60 Hz
		-	4	4.8	[Watt]	VDD= 5.0V, All Black Pattern at 75 Hz
IRush	Inrush Current	-	-	3	[A]	Note 1
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	500	[mV] p-p	VDD= 5.0V, All Black Pattern at 75 Hz

Note 1: Measurement Conditions:

The duration of rising time of power input is 470 μ s.





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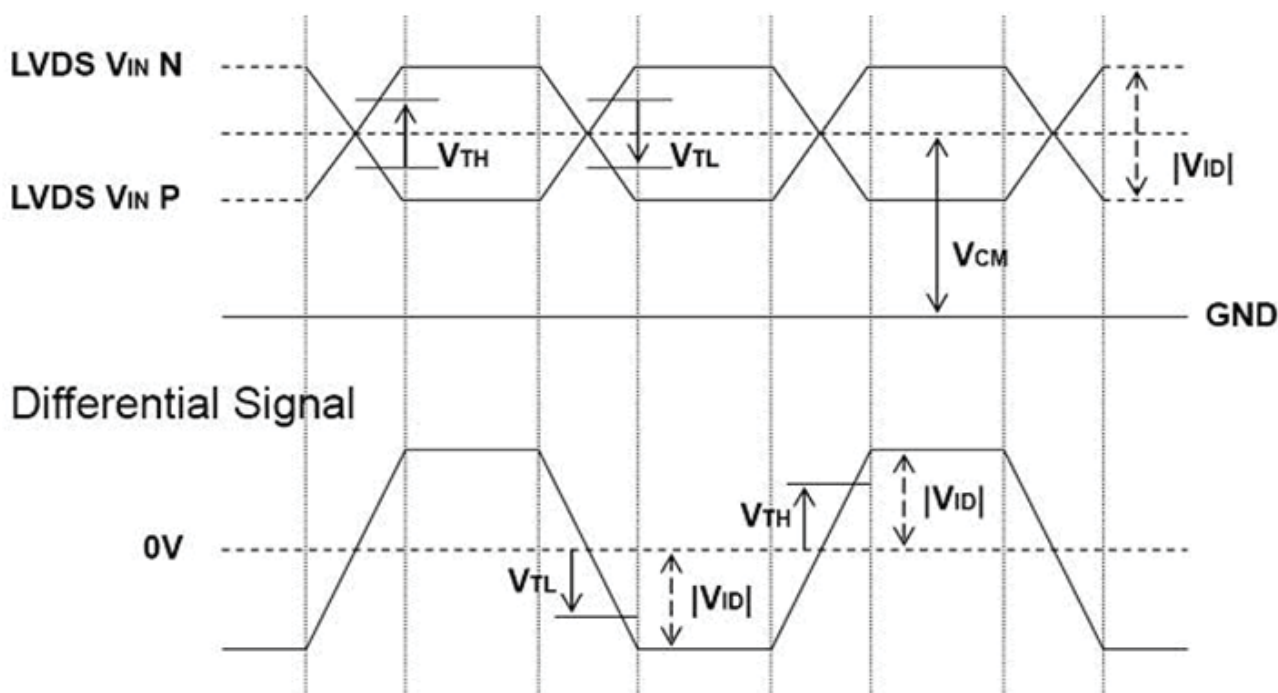
5.1.2 Signal Electrical Characteristics

(1) DC Characteristics of each signal are as following:

Symbol	Description	Min	Typ	Max	Units	Conditions
V_{TH}	Differential Input High Threshold	-	+50	+100	[mV]	$V_{CM} = 1.2V$ Note 1
V_{TL}	Differential Input Low Threshold	-100	-50	-	[mV]	$V_{CM} = 1.2V$ Note 1
$ V_{ID} $	Input Differential Voltage	100	-	600	[mV]	Note 1
V_{CM}	Differential Input Common Mode Voltage	+1.0	+1.2	+1.5	[V]	$V_{TH}-V_{TL} = 200MV$ (max) Note 1

Note 1: LVDS Signal Waveform

Single-End





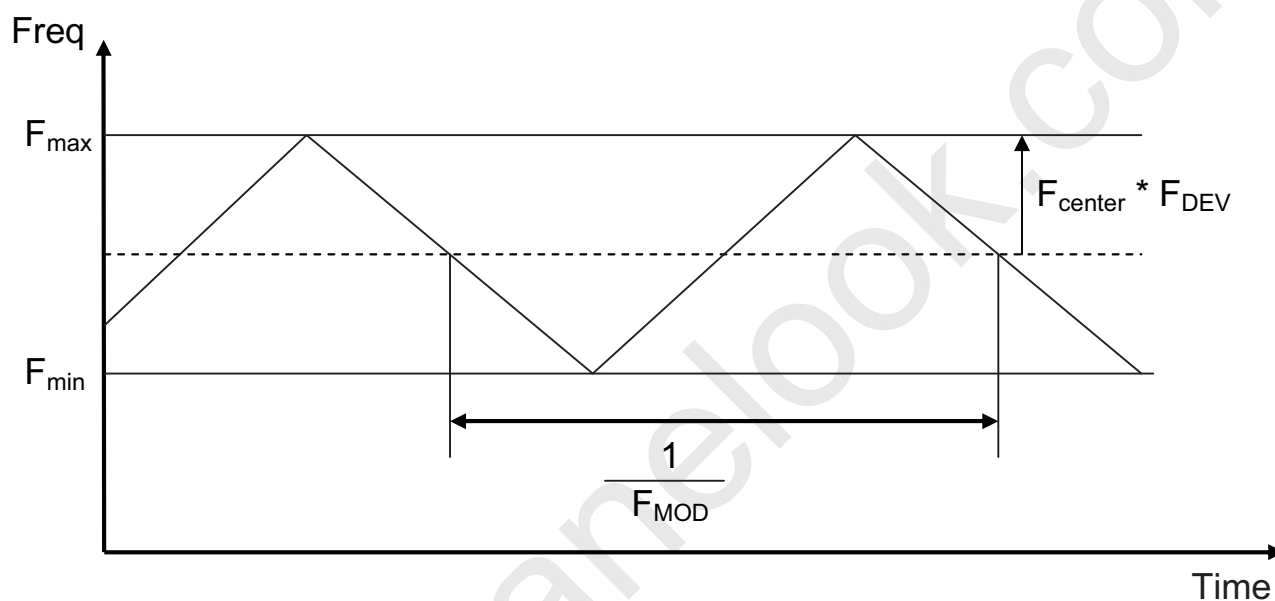
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(2) AC Characteristics

Symbol	Description	Min	Max	Units	Conditions
F_{DEV}	Maximum deviation of input clock frequency during SSC	-	± 3	%	
F_{MOD}	Maximum modulation frequency of input clock during SSC	-	300	KHz	



< Spread Spectrum >



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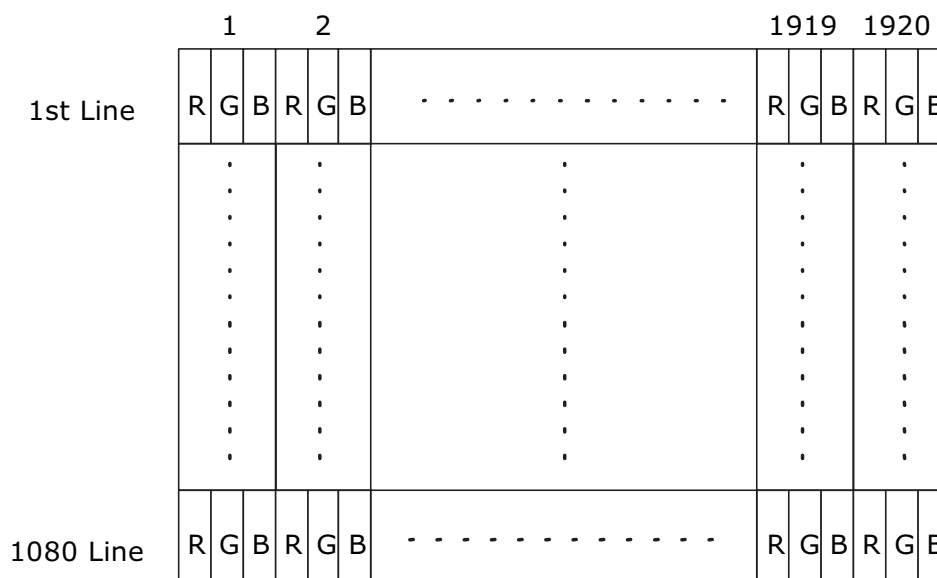
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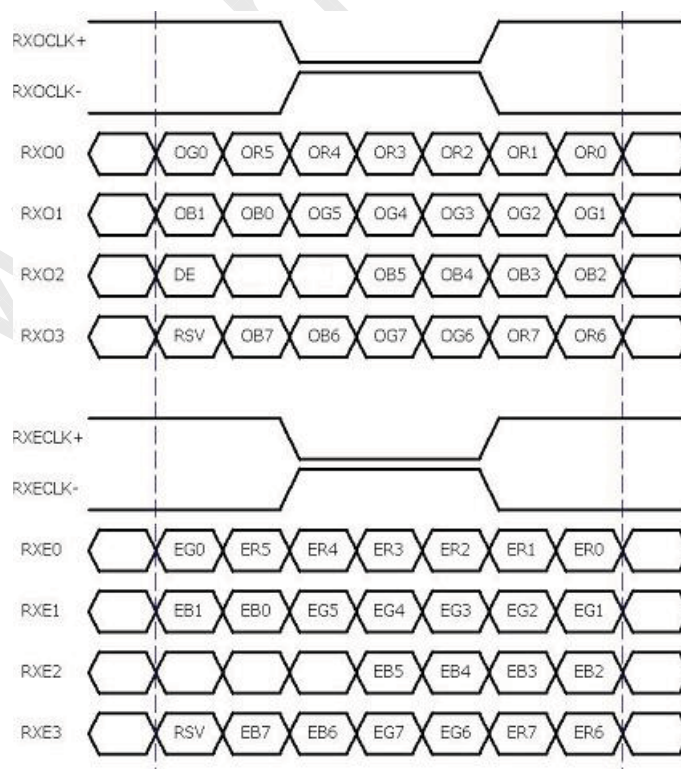
6 Signal Characteristics

6.1 Pixel Format Definition

Following figure shows the relationship between the input signals and LCD pixel format.



6.2 Input Data Format Definition



Note 1: R/G/B data 7:MSB, R/G/B data 0:LSB O = "Odd Pixel Data" E = "Even Pixel Data"



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6.3 Signal Description

PIN #	SIGNAL NAME	DESCRIPTION
1	RxOIN0-	Negative LVDS differential data input (Odd data)
2	RxOIN0+	Positive LVDS differential data input (Odd data)
3	RxOIN1-	Negative LVDS differential data input (Odd data)
4	RxOIN1+	Positive LVDS differential data input (Odd data)
5	RxOIN2-	Negative LVDS differential data input (Odd data, DSPTMG)
6	RxOIN2+	Positive LVDS differential data input (Odd data, DSPTMG)
7	GND	Power Ground
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)
10	RxOIN3-	Negative LVDS differential data input (Odd data)
11	RxOIN3+	Positive LVDS differential data input (Odd data)
12	RxEIN0-	Negative LVDS differential data input (Even data)
13	RxEIN0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RxEIN1-	Negative LVDS differential data input (Even data)
16	RxEIN1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RxEIN2-	Negative LVDS differential data input (Even data)
19	RxEIN2+	Positive LVDS differential data input (Even data)
20	RxECLK-	Negative LVDS differential clock input (Even clock)
21	RxECLK+	Positive LVDS differential clock input (Even clock)
22	RxEIN3-	Negative LVDS differential data input (Even data)
23	RxEIN3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No connection (for AUO test only. Do not connect)
26	NC	No connection (for AUO test only. Do not connect)
27	NC	No connection (for AUO test only. Do not connect)
28	VDD	Power +5V
29	VDD	Power +5V
30	VDD	Power +5V

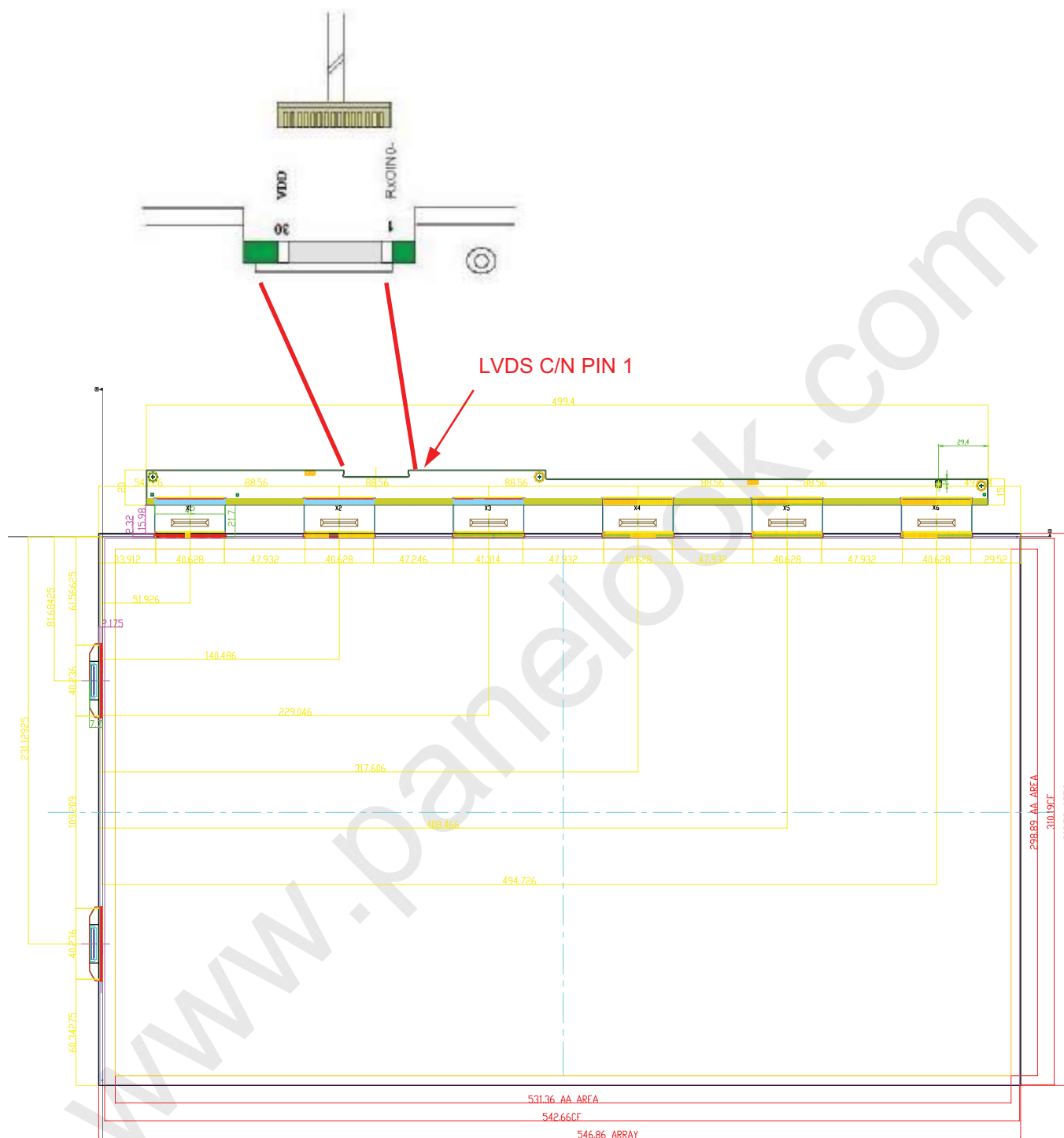
Note 1: Input signals of odd and even clock shall be the same timing.



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6.4 Timing Characteristics

The input signal timing specifications are shown as the following table

Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	T_v	1092	1130	1818	Th
	Active	$T_{disp(v)}$	1080	1080	1080	Th
	Blanking	$T_{bp(v)}+T_{fp(v)}+PW_{vs}$	12	50	738	Th
Horizontal Section	Period	T_h	1034	1050	1100	Tclk
	Active	$T_{disp(h)}$	960	960	960	Tclk
	Blanking	$T_{bp(h)}+T_{fp(h)}+PW_{hs}$	74	90	140	Tclk
Clock	Period	T_{clk}	10.6	14.0	17.7	Ns
	Frequency	Freq	56.5	71.2	94	MHz
Frame rate	Frame rate	V_{freq}	50	60	76	Hz
Hsync Frequency	Hsync Frequency	H_{freq}	55	68	91	KHz

Note 1: DE mode only

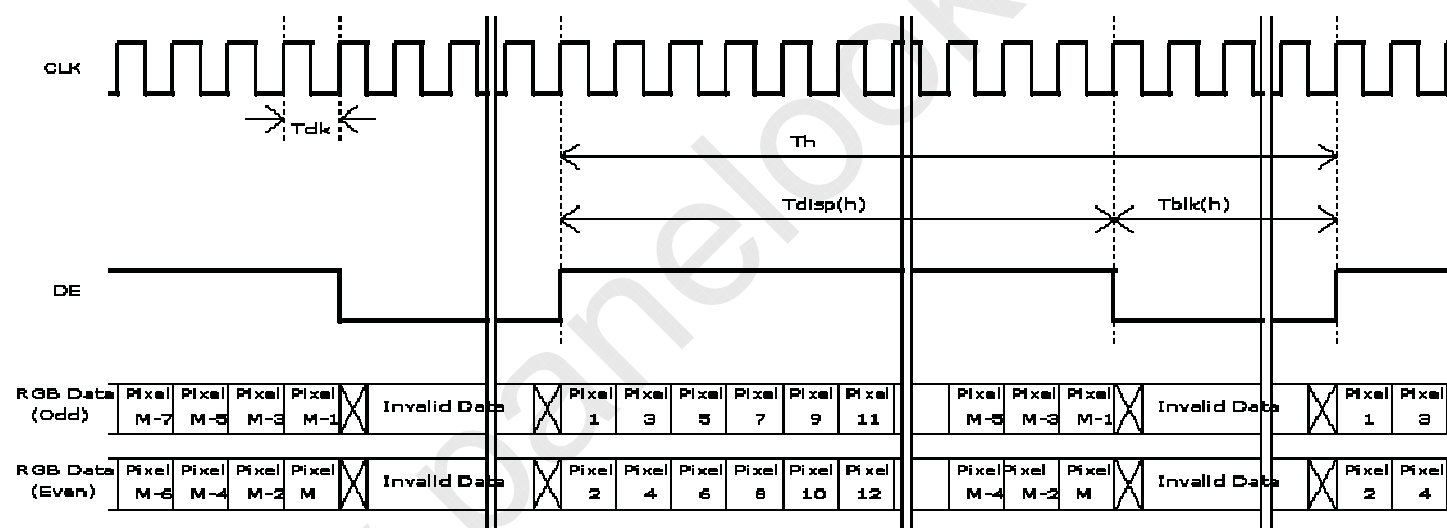
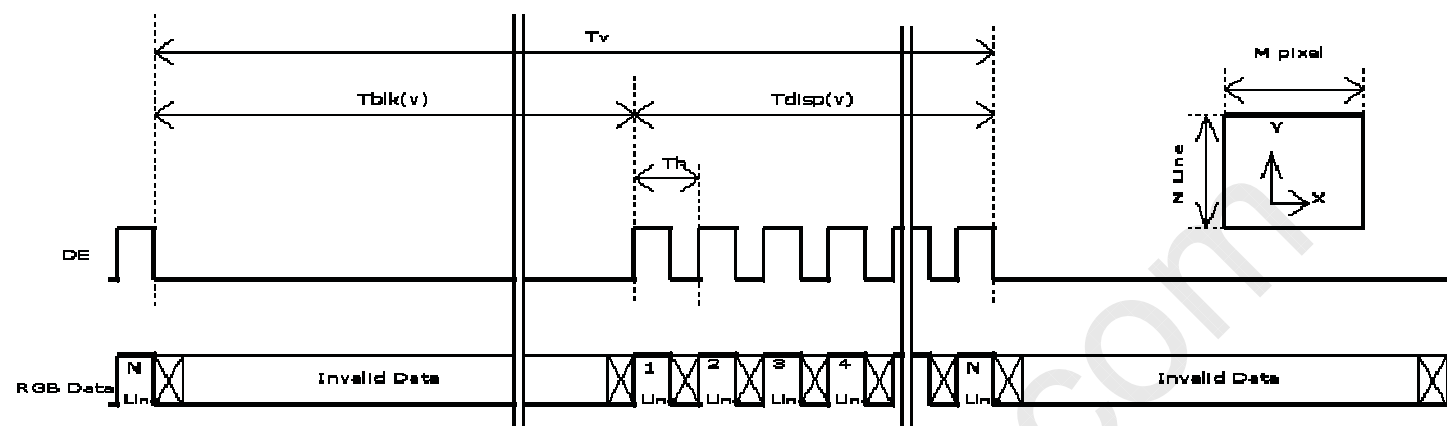


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6.5 Timing Diagram





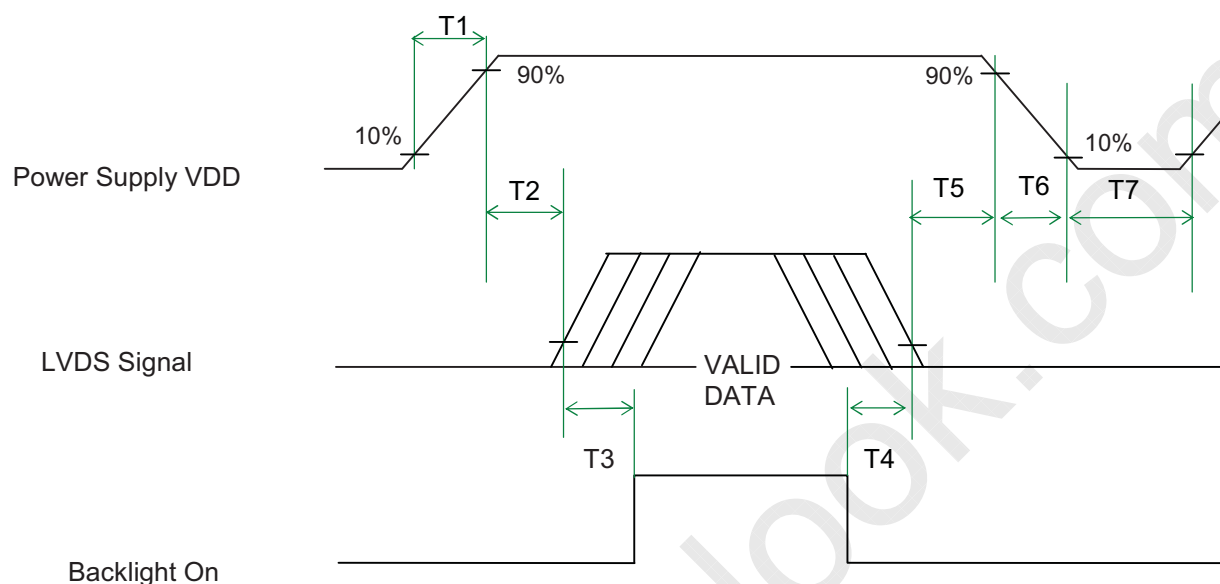
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6.6 Power ON/OFF Sequence

VDD power and lamp on/off sequence are as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state when VDD is off.



Power Sequence Timing

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	-	50	[ms]
T3	500	-	-	[ms]
T4	100	-	-	[ms]
T5	0	-	50	[ms] Note1,2
T6	5	-	100	[ms] Note1,2
T7	1000	-	-	[ms]

Note1 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note2 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.



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7 Connector and Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Module

Connector Name / Designation	Interface Connector / Interface Card
Manufacturer	P-TWO STM
Type Part Number	MSCKT2407P30HB (STM) AL230F-A0G1D-P (P-TWO)
Mating Housing Part Number	FI-X30HL (Locked Type)

7.1.1 Pin Assignment

Pin#	Signal Name	Pin#	Signal Name
1	RxOIN0-	2	RxOIN0+
3	RxOIN1-	4	RxOIN1+
5	RxOIN2-	6	RxOIN2+
7	GND	8	RxOCLKIN-
9	RxOCLKIN+	10	RxOIN3-
11	RxOIN3+	12	RxEIN0-
13	RxEIN0+	14	GND
15	RxEIN1-	16	RxEIN1+
17	GND	18	RxEIN2-
19	RxEIN2+	20	RxECLKIN-
21	RxECLKIN+	22	RxEIN3-
23	RxEIN3+	24	GND
25	NC (for AUO test only. Do not connect)	26	NC (for AUO test only. Do not connect)
27	NC (for AUO test only. Do not connect)	28	VDD
29	VDD	30	VDD



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8 Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50°C, 80%RH, 300 hours	
High Temperature Operation (HTO)	Ta= 50°C, 50%RH, 300 hours	
Low Temperature Operation (LTO)	Ta= 0°C, 300 hours	
High Temperature Storage (HTS)	Ta= 60°C, 300 hours	
Low Temperature Storage (LTS)	Ta= -20°C, 300 hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Random Frequency: 10 - 200 Hz Duration: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: $\pm X$, $\pm Y$, $\pm Z$ (one time for each Axis)	
Drop Test	Height: 46 cm, package test	
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles	Note 1
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: $\pm 15\text{KV}$, 150pF(330 Ω) 1sec, 15 points, 25 times/ point	Note 2
	Air Discharge: $\pm 15\text{KV}$, 150pF(330 Ω) 1sec 15 points, 25 times/ point	
Altitude Test	Operation: 18,000 ft	
	Non-Operation: 40,000 ft	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20°C to 60°C, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 2: EN61000-4-2, ESD class B: Certain performance degradation allowed:

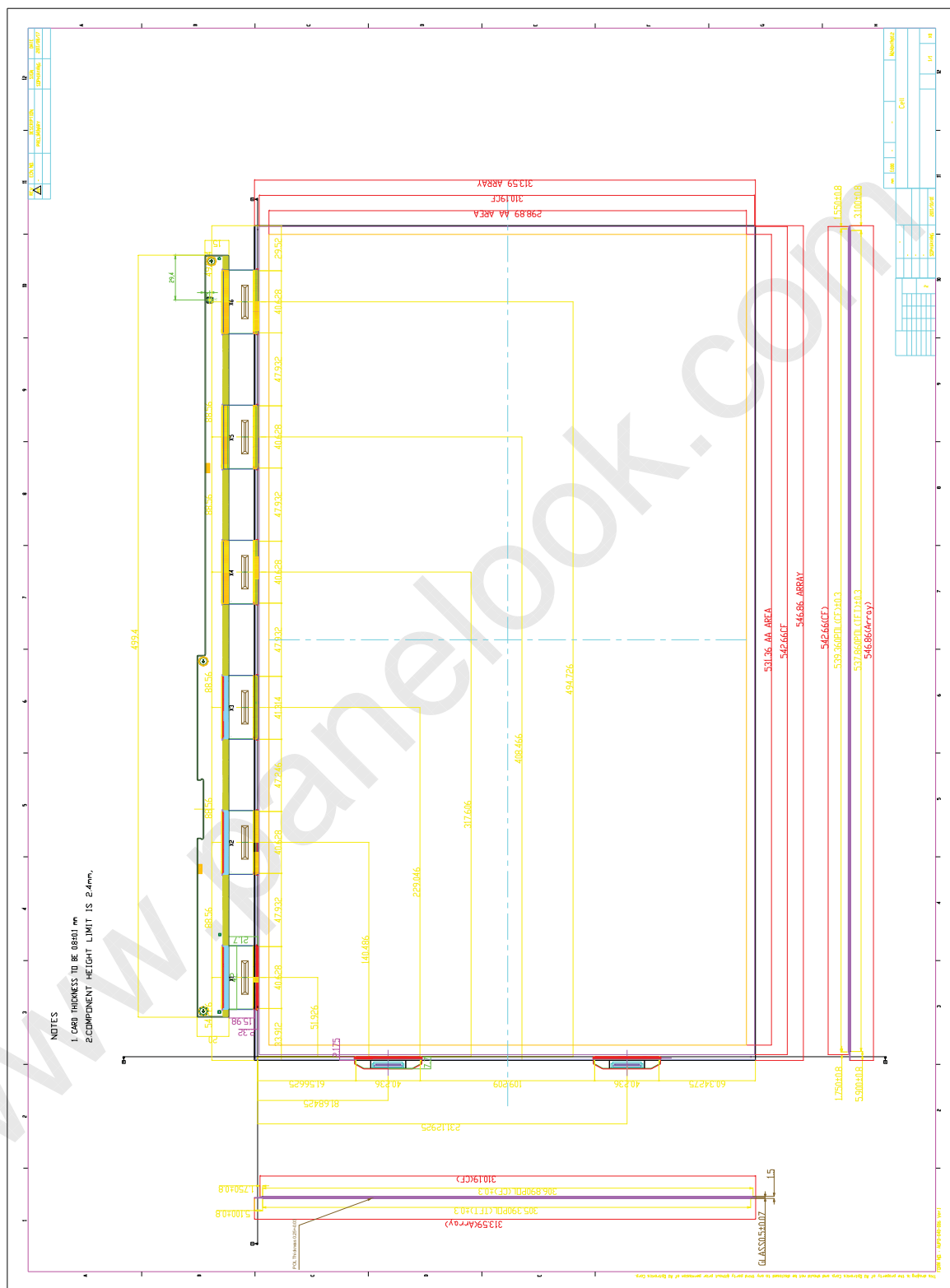
- No data lost
- Self-recoverable
- No hardware failures

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9 Mechanical Characteristics





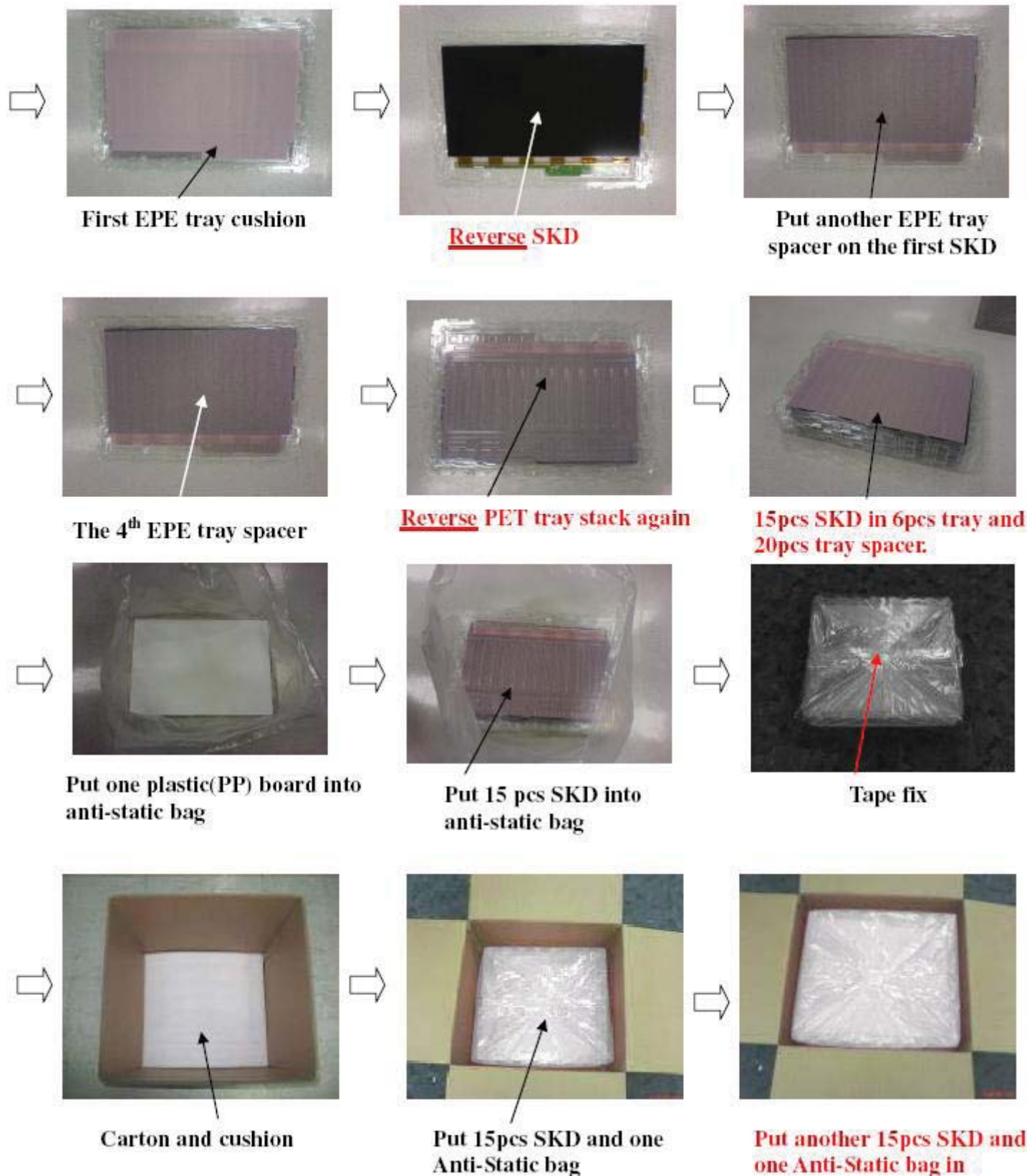
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10 Packing Specification

10.1 Packing Flow

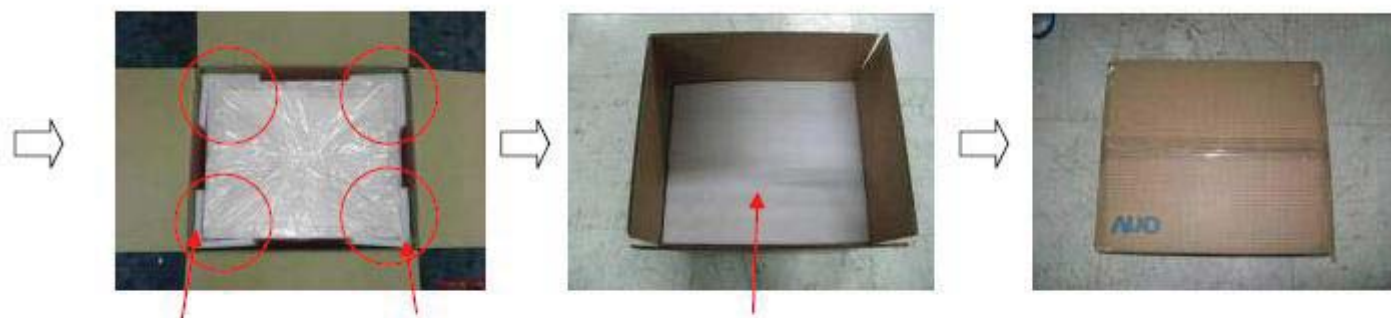




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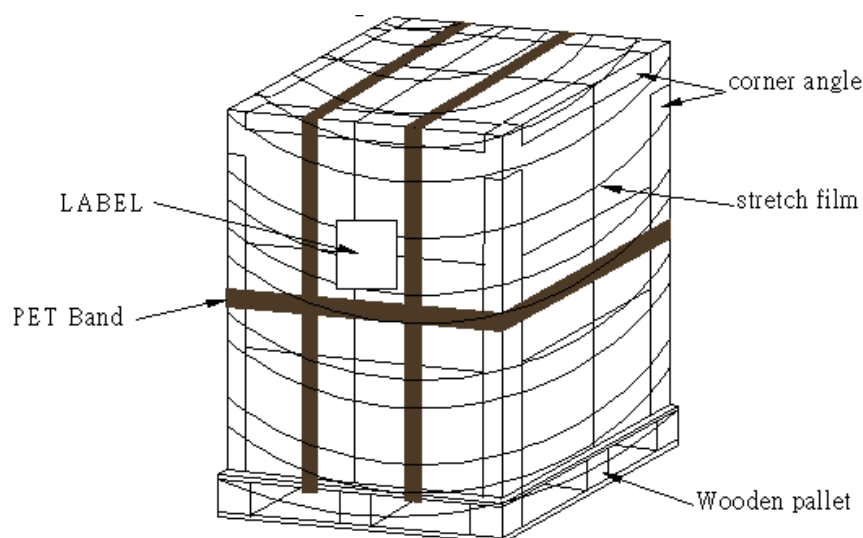
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Carton and carton cushion

Put carton cushion at the top

Tape (H type)



10.2 Pallet and Shipment Information

	Item	Specification			Remark
		Q'ty	Dimension	Weight(kg)	
1	Panel	1	546.8(H)mm x 313.5(V)mm x 1.5(D)mm	0.514	Note 1
2	Cushion	1	--	6.86	
3	Box	1	687(L)mm x 502(W)mm x 358(H)mm	1.9	without Panel & cushion Note 1
4	Packing Box	30 pcs/Box	687(L)mm x 502(W)mm x 358(H)mm	24.18	with panel & cushion Note 1
5	Pallet	1	1060(L)mm x 740(W)mm x 138(H)mm	12	Note 1
6	Pallet after Packing	8 boxes/pallet	1060(L)mm x 740(W)mm x 1570(H)mm	205.4	Note 1

Note 1: Estimated value which is subject to change based on real measured data.